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Journal of the Society of Arts.

FRIDAY, DECEMBER 19, 1856.

FIFTH ORDINARY MEETING.

WEDNESDAY, DEC. 17, 1856.

The Fifth Ordinary Meeting of the One Hundred and Third Session was held on Wednesday, the 17th inst., J. Griffith Frith, Esq., in the chair.

The following Candidates were balloted for, and duly elected members of the Society :—

Allnutt, Henry, C.E.	Routledge, Thomas
Brook, John	Shelburne, Earl of, M.P.
Brook, William	Spray, Frederick
Carlile, James William	Walters, Robert
MacGregor, John	Wethered, the Hon. John
Pillischer, M.	Wrigley, Joseph, jun.
Ritchie, George Robert	

The following School has been taken into Union since the last announcement :—

Bayswater Grammar School.

The Paper read was :—

THE IVORY AND TEETH OF COMMERCE.

BY PROFESSOR OWEN, F.R.S.

All the parts of animal bodies are, at their beginning, in a state of fluid. In this *plasma*, or formative fluid, there are numerous points or centres which, from subsequent phenomena, may be called centres of attractive or assimilative force, antagonised by centres of repellant or excretive force. The first organic forms observed, as the consequence of the co-ordinated operations of these modes of force are minute vesicles with usually central parts or nuclei, and called cells or nucleated cells. By the properties and actions of these cells, the different elements in the plastic fluid are selected, localised, and specially arranged for the formation of the future organs. Some aggregate the albuminous principle, to form the nervous system—others, the fibrinous principle, to form the muscles—others, the gelatinous principle, which becomes the basis of a vast variety of organs. The blood may be regarded as the continued and somewhat modified formative plasma, meandering or circulating in specially organised tubes, or through the interspaces, and in the substance, of the several tissues and organs. Certain parts, which have the gelatinous principle for their basis, possess the property of combining with that basis the mineral or earthy elements contained in the plasma, or blood. Some of these tissues consolidate themselves by the addition of pure flint; others—and the majority—by the addition of salts of lime,—either lime in combination with carbonic acid, or lime in combination with phosphoric acid, or with varied proportions of both salts, and with the addition, in a few cases, of fluete of lime. It is these consolidated, hard, resisting textures of animal bodies that have been found of most use in the arts. They are known by the names of bones, and shells, coral, and ivory. Art, however, derives a small amount of profit from the calcified or silicified tissues of dead animals compared with that which Nature avails herself of. They subserve and are essential to her in some of her mightiest operations on the surface of this earth. The countless and widely diversified species of soft gelatinous polypes, by the power which they possess of selecting from

the surrounding ocean and arranging in their own frail tissues the lime which is ever being carried into the ocean by the rivers that drain the land,—by the chemical power which they at the same time possess of adding to that soluble caustic lime the carbon which results from the low combustion of their vital action—relieve the sea of that mineral element which in excess would prove noxious to animal life, and at the same time lay the foundation of those enormous masses of carbonate of lime which constitute the coral islands and coral reefs that are met with in most of the tropical and warmer parts of the ocean. These examples of calcified animal tissues, after having been subjected to the mechanical action of the surf-waves, to the chemical influences of volcanic heat, and to those changes of position which are due to the expansive and upheaving forces of the same plutonic agency, become those fertile tracts of dry land which form the chalk cliffs and the limestone rocks of actual continents.

The uses which man derives from analogous calcified parts of animal tissues are comparatively few and insignificant. There is a certain commerce in shells which are used for the purpose of cameo works and other ornaments, and a smaller amount of traffic in certain forms of corals. The bones of the vertebrated animals, which are hardened, not like shells, by carbonate, but principally by phosphate of lime, are used largely in certain chemical operations. A few bones, from their greater degree of density, are serviceable for mechanical purposes; but the calcified tissue of highest value in the arts, and which, from the earliest periods of human history, has been the object of chief research for ornamental purposes, is ivory. This term is properly applied only to the substance which forms the main body of the long, projecting, hornlike teeth, called *tusks* in the elephant.

Ivory is the principal subject which, agreeably with the request that I have been favoured with by the Council of the Society, I have selected for the few observations which I shall have the honour to make this evening. I wish it were in my power to deduce from the results of the numerous and minute researches of anatomists and physiologists into the structure and mode of growth of this valuable substance, ivory, any conclusions which might lead to procedures calculated to improve its qualities, or which might be suggestive of aught that might tend to increase the quantity and diminish the price of ivory. But I am compelled to admit that the researches of science do not, in this particular, lend any efficient aid to the arts in reference to ivory.

The substance of the teeth of other animals besides the elephant is an article of commerce. Formerly, the name ivory was given to the main substance of the teeth of all animals; but it is now by the best anatomists and physiologists, restricted to that modification of dentine or tooth-substance which, in transverse sections or fractures, shows lines of different colours or striae proceeding in the arc of a circle, and forming by their decussations minute curvilinear lozenge-shaped spaces. By this character, which is presented by every the smallest portion of an elephant's tusk in transverse section or fracture, true ivory may be distinguished from every other kind of tooth-substance, and from every counterfeit, whether derived from tooth or bone. It is a character—this engine-turned decussating appearance—which is as characteristic of fossil as of recent ivory. Although, however, no other teeth except those of the elephant present the characteristic of true ivory, there are teeth in many other species of animals which, from their large size and the density of their principal substance, are useful in the arts for purposes analogous to those for which true ivory is used; and some of these dental tissues, such as those of the large tusks of the hippopotamus, are more serviceable for certain purposes, especially in the manufacture of artificial teeth, by the dentist, than any other kind of tooth-substance.

The utility of teeth in commerce and the arts depends chiefly on a peculiar modification in their laws of growth. For the most part teeth—as in our own frames—having attained a certain size and shape, cease to grow. They are incapable of renewing the waste to which they are liable through daily use, and when worn away or affected by decay, they perish. Certain teeth in man and the majority of the mammalia, are succeeded by a new tooth after the old one is worn away and shed, but this, with very few exceptions, occurs but once in the course of life. Teeth of this kind are said to be of limited growth, but there are other teeth, such as the front teeth of the rat, rabbit, and all the rodent tribe, the tusks of the boar and hippopotamus, the long descending canine tusks of the walrus, the still longer spiral horn-like tusk of the narwhal, and the ivory tusks of the elephant, which are endowed with the property of perpetual growth, that is, they grow as long as the animal lives. In the case of teeth of limited growth, the formative organ may be said to have a short life. In the case of teeth of unlimited growth, the life of the formative organ is coequal with that of the individual. The formative organ or matrix of a tooth, consists of a soft conical *pulp*, similar in shape to the first formed summit of the tooth. It is enclosed in a membranous bag, which is reflected from its base. This bag is called the *capsule*. In some teeth there is a third soft organ which is between the bag and the pulp, and connects them for a greater or less extent together. Each of these three soft parts of the matrix—the pulp, the capsule, and the intervening substance—has its own peculiar structure and mode of action upon the blood that circulates through it, by virtue of which it selects certain hardening or earthy principles—chiefly phosphate of lime—and deposits the particles thereof after a fashion peculiar to itself—whence result different dental tissues. That which is formed by calcification of the pulp is called *dentine*: that which is formed by calcification of the capsule is called *cement*: the intermediate substance, when present, forms the *enamel*.

In teeth of unlimited growth fresh pulp, fresh capsule, and in some instances also fresh enamel-organ are formed and added to the pre-existing constituents of the tooth matrix, in proportion as these are calcified or converted into tooth substance; and as fast as the ivory and enamel may be worn away from the summit of such a tooth, will ivory and enamel be formed at its base, and thus the growth of the tooth is uninterrupted. The ratio of the addition of the formative principles is at first greater than the ratio of abrasion, and the tooth not only grows, but increases in size. When, however, the animal has attained its own full growth, the tooth for the most part is reproduced without increase of size, or at most augments only in length, and that in cases where its summit is not perpetually worn down by being opposed to that of an opposite tooth.

The tusks of the hippopotamus, like the incisors of the rodents, are maintained of a certain definite shape, by being opposed to one another, but the tusks of the walrus and of the elephant, as it would seem, through the absence of opposing teeth, acquire proportionately greater length, exhibiting, indeed, the largest size to which teeth attain in the animal kingdom, and with these preliminary remarks upon the calcified tissues of animals in general, and on the general laws of dentition in the mammalian class, I proceed to the specific subject of the present discourse, which is the structure and formation of the teeth of the elephant, from which true ivory is derived.

Now, I may observe, that in the present creation elephants are restricted to the African and Asiatic continents. The African elephant, as is well known, is a distinct species from the Asiatic one, and some of the Asiatic elephants of the larger islands of the Indian Archipelago—as those of Sumatra—if not specifically distinct from the elephants of Continental Asia, form, at all events, a strongly marked variety. With reference,

however, to the commercial relations of ivory, it is chiefly worthy of notice that in the Asiatic elephants, tusks of a size which gives them the value of ivory in commerce are peculiar to the males, whilst in the African elephants, both males and females afford good-sized tusks, although there is a sexual difference of size in this species, those of the males being the largest. In former times, and, as it would seem, before man existed to avail himself of this beautiful animal substance for use or ornament, the large quadrupeds furnishing true ivory—proboscidian quadrupeds, as they are termed, from their peculiar prehensile nasal appendage—were much more widely spread over the globe, and existed in far greater numbers than at the present day—more numerous in individuals—more numerous in species—manifesting so great diversities in the conformation of their grinding teeth, as to have led the naturalist and the palæontologist to divide them into two genera, called *elephas* and *mastodon*. A true elephant roamed in countless herds over the temperate and northern parts of Europe, Asia, and America. This was the creature called by the Russians, mammoth; it was warmly clad with both hair and fur, as became an animal deriving its sustenance from the leaves and branches of trees which grow as high as the 65th degree of north latitude.

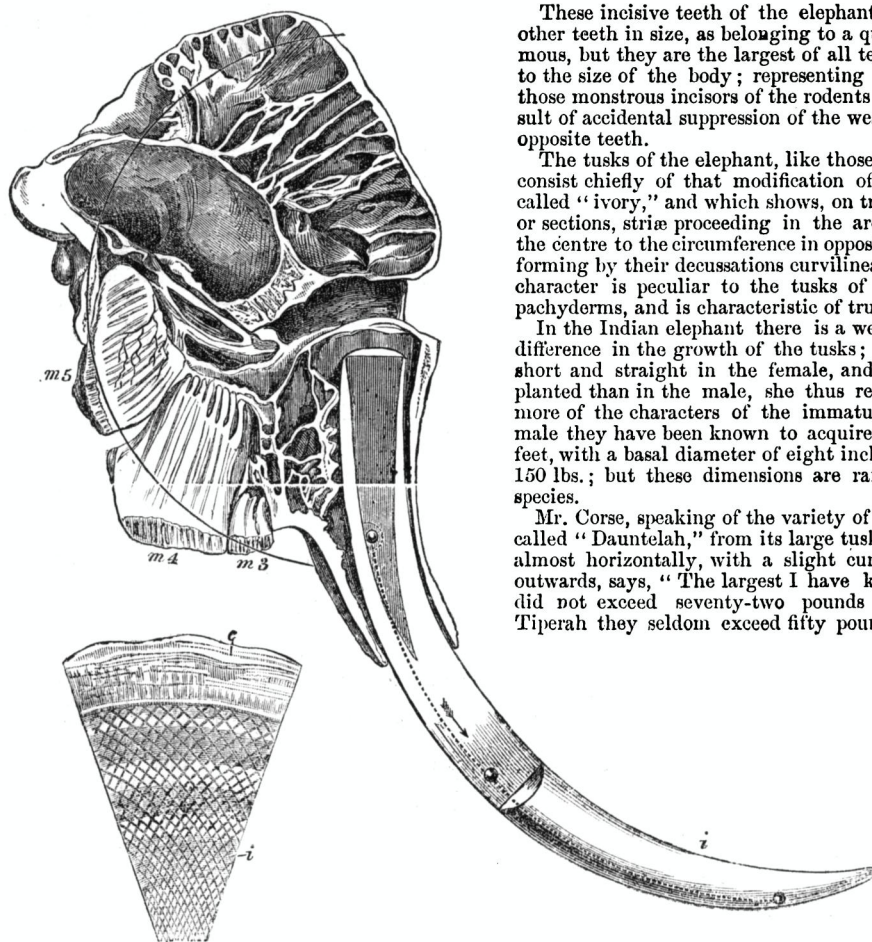
Some of the ivory of commerce is, or used to be, derived from the tusks of this extinct species, of which the individual found frozen, with all its soft parts and integuments, in the icy soil of Siberia, may be known to all. Then, there was an elephant of Southern Europe and Asia Minor,—a mastodon peculiar to the temperate and warmer parts of North America,—another species of mastodon in Central America, and two or more mastodons in South America. Australia appears likewise to have had its great proboscidian ivory-producing quadruped. The number of extinct elephants and mastodons which formerly existed in tropical Asia, and which have been restored by Cautley and Falconer, has surpassed all anticipation. No imagination can calculate the quantity of the valuable material of ivory that has been formed and has perished on this earth prior to the period of human history. At the present day, commerce is reduced to seek for that precious commodity in the tropics of the two continents—Africa and Asia. It is, of course, from our intimacy with the two existing species that our knowledge of the nature of ivory has been chiefly derived.

The dentition of the genus *Elephas*, the sole existing modification of the once numerous and various Proboscidian family, includes two long tusks (See *i* in the annexed figure), one in each of the premaxillary bones, and large and complex molars (*ib. m 3, m 5, m 2*) in both jaws: of the latter there is never more than one wholly, or two partially, in place and use on each side at any given time, the series continually being in progress of formation and destruction, of shedding and replacement; and, in the elephants, all the grinders succeed one another, horizontally, from behind forwards. The total number of teeth developed in the elephant appears to be—

$$d \frac{1-1}{0-0} \quad \frac{1-1}{0-0} \quad d m \frac{3-3}{3-3} \quad m \frac{3-3}{3-3} = 28.$$

The two large permanent tusks are preceded by two small deciduous ones, and the number of molar teeth which follow one another on each side of both jaws is certainly not less than six, of which the last three answer to the last three in the mastodon, and to the true molars of other diphodont placental mammals.

I have shown in my “Odontography” that “The deciduous tusk makes its appearance beyond the gum between the fifth and seventh months: it rarely exceeds two inches in length, and is about a third of an inch in diameter, where it protrudes from the socket: the fang is solidified, and contracts to its termination, which is commonly a little bent, and is considerably absorbed by the time the tooth is shed, which takes place between the first and second years. The socket of



the permanent tusk in a new-born elephant is a round cell, about three inches in diameter, situated on the inner and posterior side of the aperture of the temporary socket." The permanent tusks cut the gum when about an inch in length, a month or two usually after the milk-tusks are shed. At this period, according to Mr. Corse,* the permanent tusks are "black and ragged at the ends; when they become longer, and project beyond the lip, they soon are worn smooth by the motion and friction of the trunk."

Their widely open base is fixed upon a conical pulp, which, with the capsule surrounding the base of the tusk and the socket, continues to increase in size and depth, obliterating all vestiges of that of the deciduous tusk, and finally extending its base close to the nasal aperture. The ivory of the tusk is formed by successive calcification of layers of the pulp, in contact with the inner surface of the pulp cavity; and, being subject to no habitual attrition from an opposed tooth, but being worn only by the occasional uses to which it is applied, it arrives at an extraordinary length, following the curve originally impressed upon it by the form of the socket, and gradually widening from the projecting apex to that part which was formed when the matrix and the socket had reached their full size.

* See Mr. Corse's Memoir on the Teeth of the Elephant, in "Philosophical Transactions," 1799, p. 211. A good figure of the deciduous tusk is given in Plate 5.

These incisive teeth of the elephant not only surpass other teeth in size, as belonging to a quadruped so enormous, but they are the largest of all teeth in proportion to the size of the body; representing in a natural state those monstrous incisors of the rodents which are the result of accidental suppression of the wearing force of the opposite teeth.

The tusks of the elephant, like those of the mastodon, consist chiefly of that modification of dentine which is called "ivory," and which shows, on transverse fractures or sections, striæ proceeding in the arc of a circle from the centre to the circumference in opposite directions, and forming by their decussations curvilinear lozenges. This character is peculiar to the tusks of the proboscidean pachyderms, and is characteristic of true ivory.

In the Indian elephant there is a well-marked sexual difference in the growth of the tusks; they are always short and straight in the female, and less deeply implanted than in the male, she thus retaining, as usual, more of the characters of the immature state. In the male they have been known to acquire a length of nine feet, with a basal diameter of eight inches, and to weigh 150 lbs.; but these dimensions are rare in the Asiatic species.

Mr. Corse, speaking of the variety of Indian elephant called "Dauntelah," from its large tusks, which project almost horizontally, with a slight curve upwards and outwards, says, "The largest I have known in Bengal did not exceed seventy-two pounds avoirdupois; at Tipperah they seldom exceed fifty pounds." There are

varieties of the Dauntelah in which the large tusks of the male are nearly or quite straight, and in a more marked breed, called "Mooknah," the tusks are much smaller, are straight, and point directly downwards. These ascertained varieties in an existing species ought to weigh with the observers of analogous varieties in the teeth of fossil proboscideans before they pronounce definitely on their value as characters of distinct species. More anomalous varieties occasionally present themselves in the Indian elephant, as, when one tusk is horizontal and the other vertical, or when, from some distortion of the alveolus, a spiral direction is imposed upon the growth of the tusk, as in that specimen figured by Grew in the "Rarities of Gresham College," and which is now in the Museum of the Royal College of Surgeons, London. The tusk of the elephant is slightly moveable in its socket, and readily receives a new direction of growth from habitual pressure. This often causes distorted tusks in captive elephants, and Cuvier relates the mode in which advantage was taken of the same impressibility in order to rectify the growth of such tusks in an elephant kept at the Garden of Plants in Paris.

The tusks of the extinct *Elephas primigenius*, or mammoth, have a bolder and more extensive curvature than those of the *Elephas indicus*. Some have been found which describe a circle, but the curve being oblique they thus clear the head, and point outwards, downwards, and backwards. The numerous fossil tusks of the mammoth which have been discovered and recorded may be ranged

under two averages of size—the larger ones at nine feet and a-half, the smaller at five feet and a-half in length. I have elsewhere* assigned reasons for the probability of the latter belonging to the female mammoth, which must accordingly have differed from the existing elephant of India, and have more resembled that of Africa in the development of her tusks; yet manifesting an intermediate character by their smaller size. Of the tusks which are referable to the male mammoth one from the newer tertiary deposits in Essex measured nine feet ten inches along the outer curve, and two feet five inches in circumference at its thickest part; another, from Eechscholtz Bay, was nine feet two inches in length, and two feet one and a-half inches in circumference, and weighed one hundred and sixty pounds. I have also measured a specimen, dug up off Dungeness, which measured eleven feet in length. In several of the instances of mammoths' tusks from British strata the ivory has been so little altered as to be fit for the purposes of manufacture; and the tusks of the mammoth, which are still better preserved in the frozen drift of Siberia, have long been collected as articles of commerce.

In a specimen of the extinct Indian elephant (*Elephas ganesa*, F. and C.), preserved in the British Museum, the tusks are ten feet six inches in length, and in consequence of their small amount of curvature, they project eight feet five inches in front of the head; their apparent disproportion to the size of the skull is truly extraordinary, and exemplifies the maximisation of dental development.

In the account of the mammoth bones and teeth of Siberia, published in the "Philosophical Transactions" for 1737 (No. 446), tusks are cited which weighed two hundred pounds each, and "are used as ivory to make combs, boxes, and such other things; being a little more brittle, and easily turning yellow by weather and heat." From that time to the present, there has been little intermission in the supply of ivory furnished by the tusks of the extinct elephant of a former world. Cuvier† states, that the elephant of Africa, at least in certain localities, has large tusks in both sexes, and that the female of this species, which lived seventeen years in the menagerie of Louis XIV., had larger tusks than those in any Indian elephant, male or female, of the same size which he had seen.

The ivory of the tusks of the African elephant is most esteemed by the manufacturer for its density and whiteness. It has a semi-transparent aspect when recently fractured.

The molar teeth of the elephant are remarkable for their great size, even in relation to the bulk of the animal, and for the extreme complexity of their structure. I cannot omit, therefore, some notice of those teeth in the present discourse. The crown, of which a great proportion is buried in the socket, and very little more than the grinding surface appears above the gum, is deeply divided into a number of transverse perpendicular plates, consisting each of a body of dentine coated by a layer of enamel and this, again, by the less dense bone-like substance which fills the interspace of the enamelled plates, and here more especially merits the name of "cement," since it binds together the several divisions of the crown before they are fully formed and united by the confluence of their bases into a common body of dentine.

As the growth of each plate begins at the summit, they remain detached, and like so many separate teeth, or denticles, until their base is completed, when it becomes blended with the bases of contiguous plates to form the common body of the crown of the complex tooth from which the roots are next developed. The plates of the molar teeth of the Siberian mammoth (*elephas primigenius*), are thinner in proportion to their breadth,

and are generally a little expanded at the middle; and they are more numerous in proportion to the size of the crown than in the existing species of Asiatic elephant.

In the African elephant, on the other hand, the lamellar divisions of the crown are fewer and thicker, and they expand more uniformly from the margin to the centre, yielding a lozenge-form when cut or worn transversely, as in mastication.

The horizontal as well as vertical course of development of the elephant's grinder is well illustrated by the molar, the last of the lower jaw. The separate digital processes of the posterior plates are still distinct, and adhere only by the remaining cement; a little in advance they are united, to form the transverse plate; and, at the opposite extremity of the tooth, the common base of dentine is exposed by which the plates are finally blended into one individual complex grinder;* this never takes place simultaneously along the whole extent of the tooth in the Indian elephant. The African species manifests a closer affinity to the *mastodon* by the basal confluence of the plates before the anterior ones are worn out.

The formation of each grinder begins with the summits of the anterior plate, and the rest are completed in succession. The tooth is gradually advanced in position as its growth proceeds; and in the existing Indian elephant, the anterior plates are brought into use before the posterior ones are formed.

When the complex molar cuts the gum, the cement is first rubbed off the digital summits; then their enamel cap is worn away, and the central dentine comes into play with a prominent enamel ring. The digital processes are next ground down to their common united base, and a transverse tract of dentine, with its wavy border of enamel, is exposed. Finally, the transverse plates themselves are abraded to their common base of dentine, and a smooth and polished tract of that substance is produced. From this basis the roots of the molar are developed, and increase in length to keep the worn crown on the grinding level, until the reproductive force is exhausted.

When the whole extent of a grinder has successively come into play, its last part is reduced to a long fang, supporting a smooth and polished field of dentine, with, perhaps, a few remnants of the bottom of the enamel folds at its hinder part.

When the complete molar has been thus worn down to an uniform surface, it becomes useless as an instrument for grinding the coarse vegetable substances on which the elephant subsists. It is attacked by the absorbent action, and the wasted portion of the molar is finally shed. The grinding teeth of the elephant progressively increase in size and in the number of lamellar divisions from the first to the last.

There are few examples of organs that manifest a more striking adaptation of a highly complex and beautiful structure to the exigencies of the animal endowed with it, than the grinding teeth of the elephant. We perceive, for example, that the jaw is not encumbered with the whole weight of the massive tooth at once, but that it is formed by degrees as it is required; the division of the crown into a number of successive plates, and the subdivision of these into cylindrical processes, presenting the conditions most favourable to progressive formation. But a more important advantage is gained by this sub-

* Some anatomists have described the divisions of the crown of the elephant's grinder as so many "distinct teeth," and Mr. Corse (Loc. cit., p. 213), who first propounded this view, calls each complex grinder "a case of teeth," and states "that these teeth are merely joined to each other by an intermediate softer substance acting like cement." But this statement applies only to the incompletely-formed tooth; and the detached eminences of each individual plate or of the crown of any complete tooth, at that stage of growth when they are held together only by the still uncalcareous supporting matrix, might reasonably be regarded as so many distinct teeth.

* "History of British Fossil Mammals," Vol. viii., p. 247.
† Loc. cit., p. 55.

division of the tooth; each part is formed like a perfect simple tooth, having a body of dentine, a coat of enamel, and an outer investment of cement; a single digital process may be compared to the simple canine of a carnivore; a transverse row of these, therefore, when the work of mastication has commenced, presents, by virtue of the different densities of their constituent substances, a series of cylindrical ridges of enamel, with as many depressions of dentine, and deeper external valleys of cement; the more advanced and more abraded part of the crown is traversed by the transverse ridges of the enamel inclosing the depressed surface of the dentine, and separated by the deeper channels of the cement; the fore part of the tooth exhibits its least efficient condition for mastication, the inequalities of the grinding surface being reduced in proportion as the enamel and cement which invested the dentinal plate have been worn away; this part of the tooth is, however, fitted for the first coarse crushing of the branches of a tree; the transverse enamel ridges of the succeeding part of the tooth divide it into smaller fragments, and the posterior islands and tubercles of enamel pound it to the pulp fit for deglutition. The structure and progressive development of the tooth not only give the elephant's grinder the advantage of the uneven surface which adapts the millstone for its office, but at the same time secure the constant presence of the most efficient arrangement for the finer comminution of the food, at the part of the mouth which is nearest the fauces.

With regard to the *microscopic structure* of the peculiar modification of dentine called "ivory," this is characterised partly by the minute size of the tubes, which, at their origin from the pulp cavity, do not exceed $\frac{1}{100}$ of an inch in diameter, in their close arrangement at intervals scarcely exceeding the breadth of a single tube, and above all, in their strong and almost angular gyrations, which are much greater than the secondary curvatures of the tubes of ordinary dentine.

The dentinal tubes of ivory, as they radiate from the pulp cavity, incline obliquely towards the pointed end of the tusk, and describe two slight primary curves, the first convex towards that end, the second and shorter one concave; these curves, in narrow sections from near the open base of the tusk, are almost obscured by the strong angular parallel secondary gyrations. The tubes divide dichotomously, at acute angles, and gradually decrease in size as they approach the periphery of the tusk.

The characteristic appearance of decussating curved striae, with oblique rhomboidal spaces, so conspicuous on transverse sections or fractures of ivory, is due to the refraction of light caused by the parallel secondary gyrations of the tubes above described. The strong contour lines observed in longitudinal sections of ivory, parallel with the cone of the pulp-cavity, and which are smaller, circular, and concentric when viewed in transverse slices of the tusk, are commonly caused by strata of minute opaque cellules, which are unusually numerous in the interspaces of the tubes throughout the substance of the ivory, and are in very great abundance and of larger size in the peripheral layers of cement. The close-set lateral branches of the dentinal tubes unite with the tubuli of the cells. The decomposition of the fossil tusk into the superimposed conical layers takes place along the strata of the opaque cellules, and directly across the centre of the gyrating dentinal tubes.

By the minuteness and close arrangement of the tubes, and especially by their strongly undulating secondary curves, a tougher and more elastic tissue is produced than results from their disposition in ordinary dentine; and the modification which distinguishes "ivory," is doubtless essential to the due degree of coherence of so large a mass as the elephant's tusk, projecting so far from the supporting socket, and to be frequently applied in dealing hard blows and thrusts. The central part of the tusk, especially near the base of such as have reached their full size, is occupied by a slender cylindrical tract

of modified ivory, perforated by a few vascular canals, which is continued to the apex of the tusk. It is not uncommon to find processes of osteo-dentine, or imperfect bone-like ivory, projecting in a stalactitic form,* into the interior of the pulp cavity. The musket-balls and other foreign bodies which are occasionally found in ivory, are immediately surrounded by osteo-dentine in greater or less quantity.† It has often been a matter of wonder how such bodies should become completely imbedded in the substance of the tusk, sometimes without any visible aperture, or how leaden bullets may have become lodged in the solid centre of a very large tusk, without having been flattened. The explanation is as follows: A musket ball aimed at the head of an elephant may penetrate the thin bony socket, and the thinner ivory parietes of the wide conical pulp-cavity occupying the inserted base of the tusk, as represented in the figure. The hole is soon healed and filled up, by ossification of the periosteum of the socket, and of the pulp next the thin wall of ivory which has been perforated. The ball sinks below the level of this cicatrix, and the presence of the foreign body exciting inflammation of the pulp, an irregular course of calcification ensues, which results in the deposition around the ball of a certain thickness of osteo-dentine. The pulp, then resuming its healthy character and functions, coats the surface of the osteo-dentine inclosing the ball, together with the rest of the conical cavity into which that mass projects, with layers of normal ivory.

By the continued progress of growth, the ball so enclosed is carried forwards, in the course indicated by the arrow in the figure, to the middle of the solidified part of the tusk. Should the ball have penetrated the base of the tusk of a young elephant, it may be carried forwards by the uninterrupted growth and wear of the tusk, until that base has become the apex, and be finally exposed and discharged by the continual abrasion to which the apex of the tusk is subjected. Yet none of these phenomena prove the absolute non-vascularity of the tusk, but only the low degree of its vascularity. Blood circulates slowly, no doubt, through the prolongations of the pulp in the minute vascular canals which are continued through the centre of the ivory to the very apex of the tooth. And it is from this source that the fine tubular structure of the ivory obtains the correspondingly minute villi carrying the plasmatic colourless fluid by which its low vitality is maintained.

Development.—The matrix of the tusk consists of a large conical pulp, which is renewed quicker than it is converted, and thus is not only preserved, but grows, up to a certain period of the animal's life. It is lodged in the cavity at the base of the tusk; this base is surrounded by the remains of the capsule—a soft vascular membrane of moderate thickness—which is confluent with the border of the base of the pulp, where it receives its principal vessels.

I had the tusk and pulp of the great elephant at the Zoological-gardens longitudinally divided, soon after the death of that animal in 1847. Although the pulp could be easily detached from the inner surface of the pulp-cavity, it was not without a certain resistance, and when the edges of the co-adapted pulp and tooth were examined by a strong lens, the filamentary processes from the outer surface of the pulp could be seen stretching as they were withdrawn from the dentinal tubes before they broke. They are so minute that, to the naked eye, the detached surface of the pulp seems to be entire, and Cuvier was thus deceived in concluding that there was no organic connection between the pulp and the ivory. I regarded as equally valuable this rare opportunity of testing and confirming, by an examination of the recent

* Haller seems to have been the first to notice these irregular internal deposits in the pulp-cavity of the elephant's tusk.—*Elementa Physiologie*, tom. viii., p. 519.

† Cuvier, *Annales du Muséum*, tom. viii., p. 115 (1806). Goodsir, *Edin. Philos. Trans.*, 1841, p. 97.

animal, the account of the processes of conversion of those organs into the dental tissues, which I had previously given in my "Odontography."*

Having occupied so much time with that which is the main subject chosen for this evening's discourse, I must compress the few remaining observations upon the other tusks that are of commercial value, into the smallest compass.

With regard to the hippopotamus, the teeth, which are most valuable, are those called "canines" in comparative anatomy, but which, from their property of uninterrupted growth, are here called canine tusks. They are curved, consist chiefly of an extremely dense, compact kind of dentine, but are partially defended on their outside by a thick layer of enamel—so hard as to strike fire with steel. The partial application of this enamel is such as to cause the opposing ends of the upper and lower tusks to wear away obliquely, the enamel acting in this respect, like the harder layer of steel upon the chisel. The incisor teeth of the hippopotamus are also tusks, by virtue of their uninterrupted growth. They are curved in the upper jaw, straight in the lower jaw, but are smaller than the canine tusks, of less value, and are seldom imported.

In the walrus the tusks are limited to a single pair, growing from the upper jaw, and descending outside the lower jaw. Their substance is less dense and coarser than the dentine of the hippopotamus tusk, and is of proportionately less value in commerce.

The tusks of the narwhal are reduced to a single tooth in the same animal; and this, moreover, is restricted to the male sex. It grows from the upper jaw, in a straight line, parallel with the long axis of the body. It is, however, one of a pair, viz., the left one, the right tusk being abortive, but always to be found in a rudimentary state buried in the substance of the right maxillary bone. It is a very remarkable fact, that in the female there are originally a pair of these matrices or pulps, which form small rudimentary tusks, that likewise remain concealed in the substance of the upper jaw, and are only detected by dissection. In the male the functional tusk, which would seem to be given to that sex as a weapon of combat or for defence, continues to grow until it acquires the length of 9 or 10 feet, with a basal diameter of 4 inches. This is that famous "horn" which figures on the forehead of the heraldic unicorn, and so long excited the curiosity and conjectures of the older naturalists, until Olaus Wormius made an end of the speculative and fabulous "monocerologies" by the discovery of the true nature of their subject, whilst Anderson,† in the year 1736, took advantage of the accident of the stranding of a narwhal at the mouth of the Elbe, to communicate to the zoological world an accurate figure of the animal, which bore the supposed single horn. Linnaeus has embalmed the old idea of this weapon in the binomial *Monodon monoceros*, under which the narwhal is entered in the "Systema Naturæ." The exterior of the long tusk is marked by spiral ridges, which wind from within forwards, upwards, and to the left. About fourteen inches is implanted in the socket; it tapers gradually from the base to the apex. The pulp cavity, as shown in the longitudinal section of the tusk, is continued nearly to the extreme point, but is of variable width. At the base it forms a short and wide cone; it is then continued forwards, as a narrow canal, along the centre of the implanted part of the tooth, beyond which the cavity again expands to a width equalling half the diameter of the tooth, and finally, but gradually, contracts to a linear fissure near the apex.

Thus the most solid and weighty part of the tooth is that which is implanted in the jaw, and nearest the centre of support, whilst the long projecting part is kept as light as is compatible with the use of the tusk as a weapon of attack and defence. The portion of pulp

in which the process of the calcification has been arrested, receives its vessels and nerves by the fissure continued from the basal expansion of the pulp cavity.

In a few instances both tusks have been seen to project from the jaw.

In the cranium of such a narwhal, figured by Alvers, the right tusk projects only six inches from the socket, is proportionately slender, and is smooth.

With regard to the conjectured ulterior use of the concealed tusk, in the male, as a substitute in the event of the loss of the large tusk *b*, a conjecture more than once repeated by writers, since first proposed by Reisel, the solidity of the concealed tusk and its distorted and generally closed base, evince that the term of its growth has expired. The substance of the narwhal's tusk is comparatively coarse, and of little value.

In conclusion I must express my acknowledgments to Mr. Robert T. Fauntleroy, for the opportunity he has kindly afforded me of examining the very extensive and instructive series of the tusks of the elephants of Africa, India, Siam, and Ceylon, accumulated in the extensive warehouses of the firm. There, also, I had the opportunity of comparing large collections of the tusks of the hippopotamus, and specially those of the walrus and narwhal. In this collection Mr. Fauntleroy obligingly pointed out to me some singular instances of malformation—spiral tusks, for example, of the African elephant, and a lower canine tusk of the hippopotamus, which, from some accident to the opposing tusk, had proceeded in its growth until it described an entire circle. I have also to express my acknowledgments to Mr. Fauntleroy for very instructive remarks on the modifications of the ivory of tusks of elephants from different localities—localities which influence their applicability to the arts, and consequently their commercial value.

DISCUSSION.

Colonel SYKES inquired whether the Professor could account for the singular spiral curve in the horn of the narwhal.

Professor OWEN said it was according to the form of the socket. The spiral curve always ran in the same direction. He had seen only one instance in which the right tusk of the narwhal had grown out, and in that case the spiral curve was in the opposite direction. The impressions on the surface, and the curves of a tooth, were due to modifications of the cavity in which it grew.

The CHAIRMAN said he had the pleasure to announce that they were honoured this evening by the presence of Dr. Livingston, and he was sure the meeting would be delighted to hear from him the result of his lengthened experience in countries where this valuable article of commerce abounded.

Dr. LIVINGSTON said he had attended that evening for instruction, and he was afraid that he could add very little indeed to what had already been said with regard to the tusks of elephants. He had, however, seen the animal alive in great numbers in its native wilds, and he might mention a fact which, perhaps, had not come under the observation of the learned Professor, viz., that by the Africans the elephant was regarded as one of the best tests of the courage of the hunter. If a man was able to kill an elephant, it was considered by the African that he could achieve almost anything in the way of hunting. It was not considered fair sport to hunt the elephant with dogs, as in such cases undue advantage was taken of the animal, owing to his attention being so much occupied by the harassing of the dogs, that he would pay no attention to his more formidable assailant—the hunter. Sometimes he would kneel down, in an awkward endeavour to crush the dogs with his knees; at other times he would take hold of a large tree (perhaps twelve inches in diameter) and push it down in order to crush the dogs. The hunters in Ceylon, for the most part, approached within a short distance of the elephants, and killed them in the manner described

* Pp. 643—655.

† Cited by Cuvier, *Ossem. Foss.* v. pl. 1, p. 319.

by Professor Owen. In Africa the hunters generally approached to the side of the elephant within about thirty yards, and at that distance the animal was killed, on an average with about half-a-dozen balls; from a greater distance it might take 50 balls to despatch him. When residing at Kolobeng he took the trouble to put down the number of elephants that were annually killed in the country beyond. He found there hunters from England and from India—officers on furlough; there were also Boers, who considered themselves the bravest people on the face of the earth,—and native hunters and bastard Boers. The Boers and natives were exceedingly anxious to get hold of the ivory, owing to its high price. In observing the operations of these several classes of hunters and their results, he found that civilisation did not necessarily cause effeminacy: that, taking the four classes of hunters—the English officers, the Boers, the bastard Boers, or Griquas, and the natives—the number of elephants killed by the first-named was about 20, by the Boers about 2, and by the bastard Boers and natives about a half. From this fact he repeated that it would seem that civilisation did not necessarily produce effeminacy. The reason why the English hunters killed more animals than the others was because they had the courage to go closer to the elephant before they fired, whilst the others made the attack at a greater distance, and if they happened to bring down an elephant it was an event of their lives. The number of elephants in existence at the present day on the vast continent of Africa had been stated, by the celebrated hunter, Mr. Gordon Cumming, to be very large. Such was the fact; but in going northwards he found the number increased wonderfully. On the Zambesi he found an immense number of elephants, which, however, were not of so large growth as the animals in the south. He had expected, as he went further north, with rich and abundant forest vegetation, the animals would have been found much larger; but whilst the elephants of Limpopo were nearly 12 feet in length, those on the Zambesi were three feet less. The tusks, however, of the latter were much larger than those of the animals located in the southern regions. He had often attempted to account for the fact that the tusks of the smaller animal were so much larger than those belonging to the more bulky animal of the south, but he had only learned the explanation this evening from Professor Owen. The Professor had very reasonably remarked that, in those regions where the elephant had remained undisturbed by man, and passed a quiet existence, the tusks grew more regularly than in those parts where the animals were harassed, as was the case in the south, where fire-arms were in use. The elephants to the north of the Zambesi were so numerous that he could hardly imagine their ever becoming extinct. Difference of opinion prevailed with regard to the term of life of the elephant. Some persons fixed it as high as 200 years, which, he believed, had been based upon data obtained from India. Sometimes, in Africa, they saw a great number of young elephants of different sizes following the same dam, small calves, like the one now in the gardens of the Zoological Society, with others about half-grown. It would appear that the estimates of the age of the elephant, according to the data received from India, had been placed too high, but that question they might, perhaps, have an opportunity of settling by the calf now in London.

Mr. DAVENPORT said he had listened with much pleasure and interest to the remarks of the learned lecturer with reference to the tusks of the walrus, but there might be dentists in the room to whom some further information with regard to the dentition of the walrus would be very valuable.

Professor OWEN said—the subject of the paper being the teeth of commerce, and the tusks of the walrus being the least valuable, the time also being limited, he had said least upon that subject. With regard to the matters on which the last speaker had asked for information, he would refer him to a paper recorded in the

proceedings of the Zoological Society of last year, in which there was as much information upon the law of dentition in the walrus, as could be obtained from observations made on a young walrus then existing in the gardens of the Society. In addition to that, the osteological collection of the Royal College of Surgeons of London furnished, perhaps, the best series of specimens extant of dental development in the walrus, derived from the various arctic expeditions, and the stages of dentition were recorded in the published Osteological Catalogue.

The CHAIRMAN then proposed a vote of thanks to Professor Owen for the very clear and lucid information he had given upon this interesting subject—information which he ventured to say the veriest tyro in zoological science might understand, and the most learned might profit by.

The thanks of the meeting were then passed to Professor Owen.

The thanks of the Society are due to Messrs. Fauntleroy, for the loan of an extensive collection of tusks and teeth; to Mr. Tomes, Messrs. Ashe, Messrs. Smale, and Mr. Hambleton, for interesting and valuable specimens contributed by them; and to Miss Holtzapffel, for specimens of ivory and teeth, and of turned ivory.

In the Reading-room were exhibited specimens of wood-carving, by Mr. Perry; a model showing a means of converting a reciprocating into a rotary motion without the use of the crank, by Mr. Hitts; and a new chemical balance by Mr. J. Castle.

The Secretary announced that the next Ordinary Meeting of the Society would take place on the 14th of January, when a paper “On the Natural Resources of Honduras,” by the Hon. R. Temple, Chief Justice, would be read.

The Secretary has received the following letters since the meeting:—

“Sir,—In illustration of the valuable paper furnished by Professor Owen, I can add the official statistics of the trade for some years past, and a few notes which may, perhaps, come in by way of elucidation of the subject. My brother-in-law, Mr. R. B. Walker, who has only returned a few days ago from the West Coast of Africa, where he has been engaged with his brothers in trade for several years past, has given me access to his notes and documents, by which I have been able to glean some data as to prices and supply, which may be useful.

“Of late years the supply has been rather increasing than decreasing.

“In 1827 we imported upwards of 3,000 cwt.; in 1842, 5,000 cwt.; in 1850, 8,000 cwt.; nearly all of which was taken for home consumption; and the average import of the last three years has been 9,354 cwt. Whether the supply will keep up, is a question for future determination, for certainly such hunters as the late Major Rogers, of Ceylon, who killed his 2,000 elephants, and Mr. Gordon Cumming, are fast thinning out the race of those animals.

“The African elephant yields the largest tusks. Mr. Gordon Cumming has one weighing 173lbs. Mr. Cawood, of Graham’s Town, had a pair in his possession, weighing 330lbs. A tusk was recently shipped from Cameroon to Liverpool, weighing about 164lbs.; and, two or three years since, one to Bristol, weighing about 147lbs.

“The teeth proper of the elephant are worthless, and on the West Coast of Africa are never purchased.

“At the Great Exhibition in 1851 some tusks of the African elephant were shown, which weighed 162 lbs.

each, measured 8 feet 6 inches in length, and 22 inches in basal circumference.

"It is a singular fact that the domestication of the elephant is usually attended by deterioration of the length and quality of the ivory.

"The total imports of ivory in the past three years have been as follows, showing a gradual decline. The imports from the East Indies and Africa were proportionately as follows, in cwt. :—

	Africa.	Mediterranean.	East Indies.	Total.
1853.....	4,882	1,238	3,330	10,388
1854.....	3,462	1,048	3,642	9,299
1855.....	3,974	871	2,748	8,376

"The imports from India and the East, according to a parliamentary paper, have averaged about 3,341½ cwt. in the last seven years, namely :—

	Cwt.	Cwt.
1849.....	4,058	1853..... 3,123
1850.....	3,444	1854..... 3,166
1851.....	2,580	1855..... 2,599
1852.....	4,425	

"The estimated value of this ivory in 1854 was £80,733, and in 1855, £68,874. From Ceylon the quantity exported has not averaged during the last five years £200 in value. The quality of the African ivory varies considerably. That best adapted for the English market comes from the Camaroon coast, and the most esteemed runs from 50 lbs. weight upwards, the next in value 35 lbs. to 50 lbs., then from 18 lbs. to 35 lbs. All below 18 lbs. are called scrivelloes, and are of the least value, except such as are adapted to cutting billiard balls, which, in proportion to their size and cost, are the most valuable of all. Tusks are valuable in proportion to their size; those that weigh 1 cwt. or more, are the most valuable, and fetch from £40 to £50 the cwt.; the second class comprehends such as require two teeth to make a cwt. or more; the third class, three or more to the cwt.

"The highest price I have ever known ivory to bring was £55 per cwt., which has just been given. Some sold at Liverpool last year fetched £50, part of which was shipped by Mr. Walker, having been purchased by him in the neighbourhood of Camaroons, Gaboon, &c. 'This price,' he adds, 'I am assured by my owners, was never attained before, during the period they have been in the trade, though since then it has risen still higher, and I confidently expect that what I have now on the way home will realise *even more*.'

"The sea-horse teeth (so called) are the tusks of the hippopotamus.

Liberia, since it was first colonised by the American free negroes, has not, I am nearly certain, exported such a quantity of ivory as is usually asserted, though possibly at the present time it might reach 20,000 to 25,000 dols. annually, that is to say, the produce of the territories of the republic and the country immediately behind it.

"Gaboon, Loango, Congo, and Ambriz, are next to the Camaroons in quality, but much greater in quantity; Gaboon and its immediate neighbourhood, being that part of the coast which is made their head quarters by the Liverpool and Bristol traders, export an enormous quantity of ivory annually, I should say to all parts, but principally to England, France, and the United States of America—not less than 80 tons. My brother Henry, between the months of May, 1851, and November, 1852, both inclusive, shipped more than 26 tons, and there were many other traders purchasing at the same time. I, myself, have, during my stay of about 20 months, at least six of which I was without goods, purchased and shipped about 14 tons. At present ivory on this part of the coast is much dearer than it was formerly, in 1851 and 1852; in fact, the price has doubled, and in some instances more than doubled, although the Bristol traders do not frequent the Gaboon,

&c., so much. The French merchants are the principal cause of this enormous advance in price, though an allowance must of course be made for the dearness of many articles of our trade, caused by the late war, as powder, guns, rum, &c.

"My last shipment of nearly 9½ tons averages about 16½ lbs., and that is a large one, as I purchased but few scrivelloes. In fact, I think, for West African ivory, 15 lbs. would be a very fair average.

IVORY SHIPPED PER "COQUETTE," 1856.

	Weighing.	Average.
	lbs.	lbs.
1,276 elephants' tusks	20,953	16½
75 sea-horse (hippopotamus) teeth	78	1

IVORY SHIPPED PER "COQUETTE," 1855.

	Weighing.	Average.
	lbs.	lbs.
556 elephants' tusks.....	9,698	17½
15 sea-horse teeth	17	1

"This makes the average for elephants' teeth a little over 17 lbs.

"The Gold Coast ivory, and that brought down for shipment to Sierra Leone and Cape Coast Castle, ranks next, and is tolerably good. The tusks from Gambia are usually very bad, always broken, very crooked, cracked in the hollows, and more or less damaged.

"Fine ivory is known by having no cracks or flaws, either in the solid or in the hollow. Cracks in the ivory are a serious detriment, and must be always particularly noticed. The elephant's tusks that are only rather tapering in shape are most liked; very crooked teeth must be guarded against, as they cut up to great disadvantage. Broken-pointed tusks, or those with deep flaws, or otherwise damaged about the point, must be avoided. Teeth with large hollows are not at all liked, as there must inevitably be a great waste in cutting them up; in short, a fine tusk is known by being of a neat tapering shape, having a small hollow, free from cracks, with a fine, thin, clear coat, free from flaws; it is also transparent, which may be discovered by holding the point to the candle.

"The Gold Coast ivory may generally be known by having a rough hevn hole made near the end of the hollow, and is much esteemed."

I am, &c.,

P. L. SIMMONDS.

"SIR,—Allow me to offer a few remarks in connection with the subject so ably brought before the Society of Arts on Wednesday evening last by Professor Owen.

"In his admirable paper upon 'The Ivory and Teeth of Commerce,' Professor Owen alluded to the use made of the teeth of certain animals in supplying the deficiencies in the same organs in the human species, arising from certain diseases from which few persons are absolutely exempt.

"Three kinds of teeth, viz., those of the hippopotamus, walrus, and whale, are employed by dentists in the construction of artificial teeth, mineral or natural (that is human) teeth being generally fixed into the former in the anterior portions of the mouth.

"The above organic substances are unfortunately acted upon by the fluids of the mouth, in some instances so rapidly that it is necessary to have them renewed every two or three years. This great drawback to their general application has led to the introduction of gold and platinum, bodies with difficulty oxidised, as bases upon which mineral teeth may be fixed.

"There are, however, many cases in which dentine is preferable, if not absolutely necessary, and it is, therefore, of the greatest importance that search should be made for some substance which, possessing the properties of dentine, shall not be decomposed by acid or alkaline bodies.

"Many such experiments have been instituted, and, as the result, a variety of substances have, from time to time, been submitted to the notice of dentists, all, however, falling short of the required conditions.

"I am far from considering the subject exhausted, and believe it would well repay the attention of any chemist who would make a series of experiments with the view of producing an artificial ivory, even if at a cost of 20s. or 40s. per lb.; a body capable of becoming soft at a temperature 300 Fahrenheit, or forming a hard hydrate with water, would be of greater value.

"That our necessities will one day demand such a substance, I believe, notwithstanding the remark of Dr. Livingston, that in Africa the supply of elephants appears almost inexhaustible, for it seems reasonable to suppose that, as civilisation advances, and the demand for dentine increases, seas, rivers, and plains will become exhausted of their ivory-producing inhabitants. As the coal-field has supplied the deficiencies of the forest, and as the pump will probably some day supply the deficiencies of the coal cellar, so doubtless artificial dentine will supply the place of natural, and a great benefactor will be to the toothless community who first produces it.

"On other points in the learned professor's paper I will refrain from making any observations, only hoping the subject, and especially that portion of it which relates to the development of the dental tissues, will receive more general attention when the Odontological Society is in full operation.

"I am, &c.,

"A. COLEMAN.

"Spring-lodge, Wandsworth, Dec. 18, 1856."

SITE OF NEW NATIONAL GALLERY.

In the *Gazette* of Tuesday the 13th inst., it is notified that the Queen has been pleased to direct letters patent to be passed under the Great Seal, constituting and appointing the Right Hon. Lord Broughton; the very Rev. Henry Hart Milman, D.D.; Richard Ford, Esq.; Michael Faraday, Esq., D.C.L.; Charles Robert Cockerell, Esq.; and George Richmond, Esq., to be her Majesty's Commissioners to determine the site of the New National Gallery, and to report on the desirableness of combining with it the Fine Art and Archaeological Collections of the British Museum, in accordance with the recommendation of the Select Committee on the National Gallery in 1853.

Home Correspondence.

SNAKES AND THE SUPPOSED REMEDIES FOR SNAKE-BITES.

SIR,—Apropos of the experiments recently made at the rooms of the Society of Arts, which I had the satisfaction of witnessing, but more especially in reference to the letters of Dr. Chambers and Judge Temple, on snake poison and its remedies—the whole subject is one alike of scientific and popular interest, and it is possible that I may be able to add a fact or two to the stock of information bearing upon it. In the first place, however, allow me to observe, that what are called the *tropics* are not so generally infested by troublesome insects and poisonous reptiles as is commonly supposed. The number of them, in fact, their very existence there, as well as everywhere else, depends upon a variety of circumstances. In some districts they are often numerous, troublesome, and dangerous, while in others they are almost wholly unknown. But everywhere they are, if not less numerous, certainly less dangerous than is generally supposed.

I have travelled pretty extensively in Central America in all directions, throughout the length and breadth of the States of Nicaragua, San Salvador, and Honduras,

spending there upwards of two years and a-half, and have crossed and recrossed the continents eight times, from sea to sea, and followed the crests of the Cordilleras during a continuous period of upwards of thirty days. Yet I have suffered more, in a single week, from mosquitos in New York, and from fleas in Switzerland and Italy, than from either of these pests during my whole stay in Central America. In fact, during that period, with the exception of occasional annoyances from these insects, I found nothing to complain of on this score. I got a *nigua* (chigoe, or jigger) in my foot at San Juan de Nicaragua, and at Grenada was stung by a scorpion, which had ensconced itself in my boot, where it was exemplarily crushed. A little concentrated *aqua ammoniæ* rubbed over the puncture, and a trifle of strong brandy taken inwardly, prevented any perceptible consequences, beyond the original smart, which my negro servant "Ben" compared to that of being stung "by a whole hive of bees at once, and in the same spot!"

As regards snakes, I think I may affirm that, beyond a certain belt, bordering the Atlantic, and varying in width as the mountains approach the coast or recede from it, there is, perhaps, no country in the world (Ireland always excepted) so free from snakes as Central America, or at least those parts visited by me. In the vicinity of San Juan, which has a moist, hot climate, and where the country is almost covered with jungle, venomous serpents are numerous, and deaths from their bite not uncommon. The day of my arrival there, in May, 1849, was marked by a death from this cause. In ascending the river, I saw several serpents twining amongst the vines and broad-leaved plants, which lined the banks with a brilliant mosaic of leaves and flowers. Amongst them was the deadly *corral*, looking like a necklace of alternating coral and jet. In the interior, on the comparatively low and relatively wooded plains of Nicaragua, I saw one or two *corrals*, as many rattlesnakes (*cascabellas*), and several harmless boas, one of which Ben carefully *sacked*, and brought home with him as a pet.

During the year and a-half that I resided at Nicaragua, I was much engaged in exploring unfrequented places for ruins, and in investigating the ancient monuments of the country—precisely where, it would be supposed, I should have encountered serpents. But, during all of these explorations, so far as I can now remember, I found but one—a rattlesnake—a splendid fellow, with fourteen rattles in his tail!

My last expedition, running over fourteen months, was chiefly spent, at the head of a large party, in making the explorations and surveys for the proposed Honduras inter-oceanic railway. Our explorations were carried on, not only from the Gulf of Fonseca, on the Pacific, to Puerto Caballos, on the Atlantic, but embraced two of the departments of Nicaragua, and all of those of Honduras and San Salvador. Yet, so far as I can learn, not more than half-a-dozen snakes were seen by my party during the entire period of our stay. I am able to speak with emphasis upon this point, from the circumstance that we had a naturalist attached to our expedition, well provided with what the members of the party irreverently called a "pickling apparatus," for preserving specimens of all kinds of "beast, and bird, and creeping thing," which we might encounter. This gentleman (Dr. S. W. Woodhouse), moreover, had a special interest in snakes, inasmuch as he had been bitten by a rattlesnake, while attached to the United States expedition for the survey of New Mexico and the valley of the Colorado river, under the command of Captain Sitgreaves, and had recovered, to give practical force to what we are told was predicted of the seed of the woman. One of the standing rules for the observance of my corps was, that all "varmints" should be religiously given over to the Doctor; and there was a general rivalry to see who should contribute most largely to his collection. Yet his crop of snakes barely numbered

half a dozen, of which one (a *tamagasa*, called by the English negroes *Tommy Goff*) was contributed, I believe, by Judge Temple himself, at Belize.

One only, of the snakes found in Honduras (a *corral*) was poisonous. The others, as the Doctor explained to a disgusted auditory, as he picked them up with his hands, were "mere garter snakes, harmless as flies!"

I have elsewhere ("Notes on Central America," &c., p. 196,) accounted for the almost entire absence of serpents in the interior of Central America, and on the *plateaus* which make up so large a part of the country, as the consequence of "the common practice of burning the dry grass and withered vegetation during the dry season." It is undeniable, however, that serpents are quite common on the northern or Atlantic coasts of Central America. For the most part they are harmless, and are seen by the natives in their huts rather with pleasure than alarm or disgust, since they are useful in the destruction of vermin. The harmless snakes are, in general, long and slender in body, with round spots on the head, angular marks under the tail and belly, and covered with oval scales. One variety grows to a large size, and is only dreaded by the Indians, who call it *woulah*, because of its reprehensible appetite for fowls, in part set off, however, by a habit of destroying the smaller varieties of poisonous snakes. The latter are distinguished by a comparatively thick body, short tail, and a broad head, covered with scaly plates. For all these, universal report boldly testifies that the *guaca*, or what in Honduras is called *guaca*, is a reliable remedy. I had given to me what seems to be the kernel of a nut, resembling in size, shape, and general appearance the kernel of the filbert, the produce of a certain shrub which grows in Nicaragua, as a specific against the poison of snakes. It was presented to me by Dr. Juarros, of Leon de Nicaragua, who called it "*ojo de buey*," ox-eye. He also gave me written directions for its use, which I regret I have not by me at this moment, but as we had no opportunity of testing its virtues, I am unable to speak of its value.

I have mentioned that Dr. Woodhouse, the naturalist of my expedition, had himself been bitten by a rattlesnake. Being at the same time patient and practitioner, his account of his own case has a special interest, and a real scientific value; and, as I presume it has never been printed in England, I send it to you herewith, believing, that in connection with the subject now fairly up, it will be deemed worthy of attention.

I may here mention, that when in Leon, I went to visit a man who kept a "tame rattlesnake," quite loose, in his house, and was reported to be a snake charmer, or possessor of a specific against snake venom. He explained to me, however, after a little questioning, and in reply to my suggestion that he had extracted the teeth of the reptile, that he deprived it of its poison by irritating it at short intervals, and making it bite a staff of a soft porous wood, newly cut from the green tree. His hypothesis was, that the wood absorbed the poison—thus confirming the suggestion of Judge Temple, that the bite of a venomous serpent may be fatal at one time and harmless at another.

I am, &c.,
E. G. SQUIER.

EXTRACT REFERRED TO IN THE FOREGOING LETTER.

Academy of Natural Science,
Philadelphia, January 22, 1853.

SIR,—***** On Wednesday morning, the 17th of September, 1851, while Lieut. Parke and I were walking out to procure some specimens of birds, when about two miles from Zuni, New Mexico, in passing along an Indian trail, I came within a few inches of treading upon a rattlesnake, which immediately coiled himself up and prepared to strike. Jumping back, I drew my ramrod, and with it struck him over the back, with sufficient force to break it. Being a fine specimen, I wished to preserve him without further injury, when, placing my gun on his neck, and seizing it, as I supposed, immediately at the back of the head, I picked him up; but, unfortunately, I had too long a hold, and

he threw round his head and buried his fang in the side of the index finger of my left hand, about the middle of the first phalanx. The pain was intense, and momentarily produced a sickening sensation. I immediately commenced sucking the wound; at the same time I got Lieut. P. to apply a ligature round the finger, to prevent the too rapid absorption of the poison. Scarifying the finger freely, I continued sucking the wound until I returned to camp. I sent a man, who was with us at the time, immediately back to the pueblo, to bring me some *agua ammonia fortis*. He met me about three-fourths of a mile from the pueblo. I immediately applied it freely to the wound, when I was met by Mr. Kern, who wished me to try the western remedy; that is to say, to get drunk. This remedy I had often heard of, and, determined to try its efficacy, I commenced drinking whiskey. By the time I reached the pueblo I had drank about half a pint. During all this time I continued sucking the wound; then taking some ammonia internally, I scarified the finger, holding it in a basin of warm water, which allowed it to bleed freely. Already the glands in the axilla were getting sore and painful. I commenced drinking brandy; at the same time holding my finger in a cup of ammonia. It took a quart of fourth-proof brandy, besides the whiskey, to produce intoxication, which only lasted some four or five hours. During this state I vomited freely. Soon after coming to my senses, I removed the ligature, and applied a large poultice of flaxseed-meal. I repeated the ammonia internally, and took some *mass hydrag.* and *ext. colocyynth comp.* as a cathartic. In the evening the glands in the axilla were quite painful; so was also the finger; took *pulv. doveri*, grs. x.

Thursday, 18th.—Passed a restless night, without sleep, although having taken during the night *pulv. opii*, grs. iv. This morning the pain in the finger is intense; a well-marked line of inflammation extends along the arm to the axilla; had the entire arm and hand painted with tincture of iodine, and the poultice renewed; commenced taking *potassii iodidi* as an alternative. The pills not having operated, took *pulv. Seidlitz*, which had the desired effect. Diet, boiled rice. Several times, on my attempting to walk a few yards, I was seized immediately with nausea and vomiting. This continued for several days. Took at bed-time *pulv. doveri*, grs. x. The arm and hand I have resting on an inclined plane, which affords considerable relief.

Friday, 19th.—I rested pretty well last night; but this morning my arm, hand, and the glands in the axilla are much swollen and very painful. Repeated the tincture of iodine. Diet, boiled farina. Took, on retiring, *pulv. doveri*, grs. x.

Saturday, 20th.—Passed a tolerable night, but my back is getting very sore, as the blankets on the stone floor make rather a hard bed. This morning the pain is very great, and the swelling extends down the left side to the hips; renewed the tincture of iodine; removed the skin from off the finger; it discharged freely a watery, sanguineous fluid, without smell; the nail is becoming loose. The broad red line following the course of the lymphatics is now filled with yellow serum. The point where the fang entered, for the space of three-eighths of an inch, is of a dark-brown colour. This evening at bed-time took *mass hydrag.*, grs. v; *pulv. doveri*, grs. x. Continued *potassii iodidi*. Diet the same.

Sunday, 21st.—Passed a restless night, the hand being filled with serum, and much trouble with cholice; took *magnesia calcei* and *spts. mentha piperita*. My bowels not being opened, took *pulv. Seidlitz*, and was relieved.

Monday, 22nd.—Passed a comfortable night, the swelling having left my side and arm; but little remains in the hand. Continued *potassii iodidi*. Low diet. I can now walk a few yards without nausea, and am able to sit up for most of the day. Diet, mutton broth and farina.

Tuesday, 23rd.—I awoke this morning feeling much improved, the swelling and pain having left, with the exception of the finger, the first and second joints of which do not present a healthy appearance, the palmar surface having much the appearance of gangrene; but the discharge is thin and watery. I can detect no smell. The granulations do not present a healthy appearance; they are rough, and many of them look as if they were sprinkled with yellow ochre. The nail is quite loose. Continued *potassii iodidi*. Diet, mutton broth, with a little of the meat.

Wednesday, 24th.—This day we commenced our march; after going six miles, encamped. I placed my hand in a sling, and it was with the greatest difficulty I could manage the mule with one hand, being rather weak, and the animal rather obstinate. The sun was very hot; this, with the jolting, caused me to suffer considerable pain.

I removed the nail; from this time the finger gradually im-

proved. Continued the poultice until the last of October, when I applied *cerate simplex*. In the mean time there was a large slough, which gradually came away and left the last phalanx exposed in two places. The granulations required occasionally the application of the nitrate of silver. Continued with my hand in a sling until about the middle of November.

A new nail commenced growing, and a small sinus remained in the end of the finger; upon the introduction of a probe into which, the bone could be felt quite rough. A discharge from this kept up until about the 7th of February, when I removed the exfoliation of the end of the last phalanx, showing evidently that the fang had entered the periosteum. Soon after this the sinus closed, leaving it in a deformed state, anchylosis having taken place in the first joint. The circulation is very imperfect, one of the arteries being destroyed, which renders it very susceptible to cold. The insertion of the flexor muscle is also destroyed.

I am, Sir, with much respect, your obedient servant,
S. W. WOODHOUSE, M.D.,
Surgeon and Naturalist to the Expedition.
Brevet Captain L. Sitgreaves,
U. S. Topographical Engineers, Washington.

UTILISING SEWAGE.

SIR,—With reference to Mr. Cooke's deeply interesting paper, will you permit me to reply to an oversight on Mr. Wright's part, who asks, "if the Leicester sewage bricks sell at 2s. a ton, can your lime be got at 2s. a ton," to which I reply, Mr. Cooke states that £16,250 worth of lime could precipitate £30,000 worth of manure, valuing at 2s. a ton, or £60,000 if valued at 4s., viz., at the price received for the article at Leicester.

With regard to the chemical objection that lime will not precipitate the ammonia—then I reply the ammonia remains in the water that is passed off, and if so, why should there not be a canal constructed through Essex, and another through Kent, to carry off this perfectly odourless water, to be utilised as it passes along, or, when not demanded, passed on to the German ocean if necessary. But when we remember that the meadows near Edinburgh, through which the sewage flows, let at £30 and £40 an acre per annum! it appears little less than madness to waste the enormous manuring wealth flowing from three million human beings.

I am, &c.,
GEO. WYLD, M.D.

PRECIPITATION OF SEWAGE FROM WATER.

SIR,—In the last number of the journal I observe, that Mr. Higgs contends with Mr. Wicksteed for the invention of the process of adding lime to water for the purpose of precipitating the "sewage" from it. Some of your members may not perhaps be aware that as far back as 1841, many experiments were made, and with perfect success, by Dr. Clark, of Aberdeen, upon the water of the Medlock, at Manchester, to precipitate the sewage and filth from it, and to sweeten the water before it entered the Duke of Bridgewater's Canal, and Dr. Clark urged its adoption on more than one occasion upon the canal authorities. He had established that it would require about one ton of lime per day.

I was myself aware of this many years back; but every one still having doubts about it, may, I think, have them removed by reading a correspondence which took place on the subject in the *Manchester Guardian* of 14th, 15th, 17th, and 18th of April last.—I am, &c.,
DUGALD CAMPBELL.

7, Quality-court, Chancery-lane, Dec. 16.

Proceedings of Institutions.

COVENTRY.—On Thursday evening, the 27th of November, a lecture, "On Zoology," was delivered in St. Mary's Hall, by Dr. Treveltham Spicer, before the members and supporters of the Institute. The lecturer took

a broad view of the subject, so as to make it interesting to a mixed audience. The hall was well filled, and the clear and able manner in which each portion of the subject was treated rendered the lecture not only instructive, but highly gratifying to all present.—Miss Lizzy Stuart gave her Scottish entertainment entitled "A Peep at Scotland through her Songs," before the members of the Institute, on Thursday, the 4th inst., and gave great pleasure to a large audience.

ROYSTON.—Two lectures which afforded unusual gratification to the members of the Institute, were recently delivered by George Grossmith. They were entitled "Pickings from Pickwick," and "Martin Chuzzlewit," and form part of a course on the writings of Charles Dickens.

To Correspondents.

Erratum.—At page 63, first column, line 18, for "secretary" read "architect."

MEETINGS FOR THE ENSUING WEEK.

- MON. London Institution, 7. Dr. Tyndall, "On the Nature and Phenomena of Light."
WED. London Institution, 3. Professor Rymer Jones, "On Vivaria and their Inhabitants."
SAT. London Institution, 3. Mr. T. A. Malone, "On Experimental Physics, chiefly in Relation to Chemistry."
Royal Institution, 3. Professor Faraday, "On the Gravitating Force."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[From Gazette, December 12th, 1856.]

- Dated 30th August, 1856.
2018. François Long, Paris—Improvements in life-boats.
Dated 19th September, 1856.
2195. William John Bisseker, 13, Ludgate-hill, Birmingham—Improvements in strings or wires used in or on musical instruments.
Dated 24th September, 1856.
2238. Joseph Bennett Howell, Sheffield, and Nicholas Harvey, 12, Haymarket—Improvements in steam and other boilers.
Dated 27th October, 1856.
2520. James Fenton, Low Moor, near Bradford, Yorkshire—An improved method of and signal apparatus for preventing accidents on railways.
Dated 8th November, 1856.
2630. William Gossage, Widnes, Lancashire—Improvements in the manufacture of carbonates of zinc, of iron, and of manganese, and in the useful application of such carbonates.
Dated 21st November, 1856.
2754. Auguste Mathieu Maurice de Bergevin, Sermon-lane, City of London—A method or methods of purifying coal without decarbonisation.
2758. Charles Tooth, Burton-upon-Trent—Improvements in charging or filling and filling up casks or other vessels for containing fermenting liquids.
2760. Sigmund Rothenheim, London—An improved walking-stick pipe.
2764. Samuel Russell, Darnley-terrace, Gravesend—Improvements in the construction of scissors and shears.
2766. Charles Garton, and James St. John Gage Parsons, Bristol—A method of treating cane sugar, in order to fit it to be employed in brewing and distilling.
Dated 22nd November, 1856.
2770. George Bell Galloway, 42, Basinghall-street—Improvements in furnaces for steam boilers and other uses.
2774. Joseph Wheeler, Wootton-under-Edge, Gloucestershire—A method of converting rotary into reciprocating motion, especially applicable to machinery for forcing plastic substances through moulds and dies.
2776. John Skirrow Wright, Birmingham—Improvements in the manufacture of paper or papier maché and metal buttons.
2778. David Chadwick, Salford, and Herbert Frost, Manchester—Improvements in apparatus for measuring water and other fluids and gas.
Dated 24th November, 1856.
2780. Edmund Hunt, Glasgow—Improvements in looms for weaving ornamental fabrics.
2782. James Broadley, Saltaire, Yorkshire—Improvements in weaving.
2784. Masta Joscelin Cooke, 45, Dean-street, Newcastle-on-Tyne—Certain improvements in washing, wringing, and mangling machines.
2786. William Henry Aston and Samuel Hopkinson, Zetland Mills, Huddersfield—Improvements in steam-boiler furnaces and apparatus employed for supplying water to steam boilers.

2788. Charles Edwin Heinke, Great Portland-street—Improved apparatus for illuminating objects beneath the surface of water, or for giving light in mines and other places where combustible or explosive gases exist.

2790. George Sharp and William Elder, Jarrow, Durham—Improvements in steam hammers and machinery for forging iron and other substances.

Dated 25th November, 1856.

2792. Henry Bragg, jun., Belfast—Improvements in drying or extracting moisture from air, and in machinery or apparatus for starching, clearing, drying, stretching, and finishing fabrics.

2794. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for embroidering. (A communication.)

2796. Jacob Levi Elkin, Jeffrey's-square, St. Mary Axe—An improved process applicable to the manufacture of zinc. (A communication.)

2797. John Marshall, jun., Selby, Yorkshire—An improvement in the purifying of oils and fatty matters.

2798. Alfred Vincent Newton, 66, Chancery-lane—Improved machinery for forging iron. (A communication.)

Dated 26th November, 1856.

2800. John Brown, Bolton-le-Moors, and John Adin, Manchester—Certain improvements in Jacquard machines.

2801. Léon Germain Riant, 39, Rue de l'Echiquier, Paris—An improved mode of preparing whalebone, gutta percha, and other elastic bands employed in the manufacture of wearing apparel.

2803. Matthew Henderson, Glasgow—Improvements in cutting, sawing, or shaping and polishing stone.

2805. Alfred Vincent Newton, 66, Chancery-lane—An improvement in the process of coating iron bolts, bars, sheets, spikes, nails, and other articles of iron, with metallic alloys, for the prevention of rusting or oxydation. (A communication.)

2806. Henry Eastman Palmer, Stonehouse, Devon—Improvements in photographic apparatus.

Dated 27th November, 1856.

2807. Asa Lees and David Schofield, Oldham—Certain improvements in self-acting mules for spinning and doubling.

2808. Peter Armand le Comte de Fontaine-moreau, 39, Rue de l'Echiquier, Paris—Improved weighing apparatus. (A communication.)

2809. William Armand Gilbee, 4, South-street, Finsbury—An improved mode of reefing and reducing topsails. (A communication.)

2810. William Woofe, Weston Birt, Gloucestershire—An implement for paring land, applicable also to the removing of turf.

2811. Paul Rapsey Hodge, 4, Albion-grove, Barnsbury-park—Improvements in the manufacture of felted cloth.

2812. Henry Hedgely, 32, New-road, Brighton—Certain improvements in spirit lamps.

Dated 28th November, 1856.

2815. James Higgin, Manchester—Improvements in treating certain vegetable dye-stuffs, or preparations therefrom, so as to obtain a colouring substance of increased purity.

2817. Auguste Cellier, 39, Rue de l'Echiquier, Paris—Improved mullage, applicable to the sizing and printing of textile materials.

2819. Henry Turner Sourbutts, Hyde, Cheshire—Improvements in taps or valves, part of which are applicable to lubricators for steam engines, and other purposes.

2821. Archibald Turner, Leicester—Improvements in the manufacture of elastic fabrics.

Dated 29th November, 1856.

2823. John George Taylor, Glasgow—Improvements in pencil cases.

2825. James Dryden, Dundee—Improvements in weaving.

2829. John Brown, Liverpool—Improvements in the construction of the lower masts of ships.

2831. Joseph Latimer Clark, Adelaide-road, Haverstock-hill, Hampstead—Improvements in electric telegraphs. (Partly a communication.)

Dated 1st December, 1856.

2833. Joseph Worthington, Manchester—Improvements in telegraphing and communicating on railway trains.

2835. John Christian Jones, 17, Poland-street, Oxford-street—The improvement of the common pin wooden leg and crutch.

2837. John Gedge, 4, Wellington-street South, Strand—Improvements in gas meters. (A communication.)

2839. John Gibson, Paddington—Improvements in buffing and drawing apparatus.

2841. Edward Jackson Emmons, Massachusetts, U.S.—A new or improved nursery chair. (A communication.)

2843. Francis Peabody, St. James's-street, Westminster—Improved apparatus for obtaining motive power by the action of the wind.

2845. Henri Nicolas Denis Bardot, Paris—Improvements in treating or preparing colours for printing.

Dated 2nd December, 1856.

2847. Edmund Dwyer, Woolwich—Improvements in the manufacture of children's chairs.

2849. John Longbottom, Leeds—Improvements in apparatus for drying, roasting, carbonizing, and calcining vegetable, mineral, and animal substances.

2851. Richard Archibald Brooman, 166, Fleet-street—Improvements in bleaching. (A communication.)

2853. Richard Archibald Brooman, 166, Fleet-street—Improvements in pumping engines and in pumps. (A communication.)

2855. John Fowler, jun., Havering, Essex—An improvement in the manufacture of wire ropes.

2857. Robert Dryden, Kinaston-street, Lambeth, and Stephen Miles, South-terrace, Willow-walk, Bermondsey—An improvement in the construction of cylinder printing presses.

2859. Alfred Bower, Liverpool—Improvements in or applicable to the keels of navigable vessels.

2861. Frederic Siemens, 7, John-street, Adelphi—Improved arrangement of furnaces, which improvements are applicable in all cases where great heat is required.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2878. Ebenezer Daggett Draper and George Draper, Massachusetts, U.S.—New and useful improvements in oil feeders, vessels, or cans for oiling machinery. (Partly a communication.)—4th December, 1856.

WEEKLY LIST OF PATENTS SEALED.

December 12th.

1392. Philip Unwin and John Unwin.

1394. James Fairclough.

1414. William Seed.

1415. Edward Lindner.

1420. James Ball Mannix.

1434. Raymond Leopold De Benger.

1435. Thomas Burton.

1449. Jacinto Dias Damazio.

1501. Gustave Durrich.

1531. Ebenezer Rogers and Herbert Mackworth.

1542. John Lacey Davies, junr., and John Broadbent.

1553. William Frederick Spittle.

1775. Isham Baggs.

1932. James Leach, William Turner, and John Tempest.

2294. John Holman.

December 16th.

1430. Frederick Collier Bakewell.

1442. William Hunt.

1448. William Parsons.

1452. John Talbot Pitman.

1455. Jonathan Hague.

1468. Goldsworthy Gurney.

1502. John Gratrix and Alfred Knight.

1510. Basilio Scariano and Raphael Paul de Villamil.

1514. Charles Augustus Preller.

1518. George Henry Ormerod.

1526. Charles Armand Massager.

1536. Charles Woide Goodhart.

1554. Edwin Green.

1562. Alfred Vincent Newton.

1729. Clothide Amet.

1936. Henry Burden.

2096. Alfred Vincent Newton.

2217. Thomas Evans Blackwell.

2243. Thomas Holmes and Thomas Aspinall.

2252. Matthew Andrew Muir and William James Walker.

2360. Henry Watson and John Dixon.

2424. Jane Elizabeth Reed.

2430. John Mc Dowall.

2434. Alfred Vincent Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

December 8th.

2859. Pierre Marie Fouque, Louis René Hébert, and Vincent Etienne Doret le Marneur.

2892. Christian Schiele.

December 9th.

2897. Frederick Grace Calvert.

December 10th.

2899. John Zuill Kay.

83. Auguste Edouard Loradoux Belford.

December 12th.

2890. James Wansbrough.

2921. William Tranter.

2933. Charles Goodyear.

2942. John Greenwood.

2956. Josiah Latimer Clark.

December 13th.

2897. John Ambrose Coffey.

2912. Jean Baptiste Pascal.

2913. Frederick William Branstons.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3908	Nov. 28.	A Brougham.....	Cook, Rowley, and Co.....	King-street, Golden-square.
3909	Dec. 2.	Improved Angler's Winch Handle.....	William Deller	67, Crooked-lane.
3910	" "	Clock or Timepiece Dial Plates.....	James Cooke.....	Birmingham.
3911	" 3.	An Improved Mantle.....	H. J. and D. Nicholl.....	Regent-street and Cornhill.
3912	" 5.	Glass Chimney for Lamps.....	William Palmer, jun.....	Sutton-street, Clerkenwell.
3913	" 6.	Mole Trap.....	Samuel Griffiths.....	Wolverhampton.
3914	" 11.	Rib for Umbrellas and Parasols.....	Samuel Smith.....	Birmingham.
3915	" 12.	Anti-Garotte Boot Bayonet.....	Albert Delfosse.....	1, St. Swithin's-lane.
3916	" 15.	A Spring Buckle.....	Samuel Unite.....	Birmingham.
3917	" 16.	Anti-friction Serving Mallet.....	Theophilus Westhorp.....	West India Dock-road
3918	" "	Carpet Fastening.....	James Parkes and Son.....	Birmingham.